What Is Claimed Is:

1. A method for using a computer system to solve a global optimization problem specified by a function f and a set of equality constraints, the method comprising:

receiving a representation of the function f and the set of equality constraints $q_i(\mathbf{x}) = 0$ $(i=1,\ldots,r)$ at the computer system, wherein f is a scalar function of a vector $\mathbf{x} = (x_1, x_2, x_3, \ldots x_n)$;

storing the representation in a memory within the computer system;

performing an interval global optimization process to compute guaranteed bounds on a globally minimum value of the function $f(\mathbf{x})$ subject to the set of equality constraints;

wherein performing the interval global optimization process involves,

applying term consistency to the set of equality constraints over a subbox **X**, and

excluding portions of the subbox **X** that can be shown to violate any of the equality constraints.

2. The method of claim 1, wherein performing the interval global optimization process involves:

preconditioning the set of equality constraints through multiplication by an approximate inverse matrix **B** to produce a set of preconditioned equality constraints;

applying term consistency to the set of preconditioned equality constraints over the subbox **X**; and

excluding portions of the subbox **X** that can be shown to violate any of the preconditioned equality constraints.

3. The method of claim 1, wherein performing the interval global optimization process involves:

keeping track of a least upper bound f_bar of the function $f(\mathbf{x})$;

unconditionally removing from consideration any subbox for which $inf(f(\mathbf{x})) > f\_bar$;

applying term consistency to the inequality $f(\mathbf{x}) \leq f\_bar$ over the subbox $\mathbf{X}$; and

excluding portions of the subbox $\mathbf{X}$ that violate the inequality.

4. The method of claim 1, wherein applying term consistency involves:

symbolically manipulating an equation within the computer system to solve for a term, $g(x_j)$, thereby producing a modified equation $g(x_j) = h(\mathbf{x})$, wherein the term $g(x_j)$ can be analytically inverted to produce an inverse function $g^{-1}(y)$;

substituting the subbox $\mathbf{X}$ into the modified equation to produce the equation $g(X'_j) = h(\mathbf{X})$;

solving for $X'_j = g^{-1}(h(\mathbf{X}))$; and

intersecting X'_j with the interval X_j to produce a new subbox $\mathbf{X}^+$;

wherein the new subbox $\mathbf{X}^+$ contains all solutions of the equation within the subbox $\mathbf{X}$, and wherein the size of the new subbox $\mathbf{X}^+$ is less than or equal to the size of the subbox $\mathbf{X}$.

5. The method of claim 1, wherein performing the interval global optimization process involves:

applying box consistency to the set of equality constraints $q_i(\mathbf{x}) = 0$ $(i=1,\ldots,r)$ over the subbox $\mathbf{X}$; and

excluding portions of the subbox $\mathbf{X}$ that violate the set of equality constraints.

6. The method of claim 1, wherein performing the interval global optimization process involves:

evaluating a first termination condition;

wherein the first termination condition is TRUE if a function of the width of the subbox $\mathbf{X}$ is less than a pre-specified value, ε_X, and the absolute value of the function, f, over the subbox $\mathbf{X}$ is less than a pre-specified value, ε_F; and

if the first termination condition is TRUE, terminating further splitting of the subbox $\mathbf{X}$.

7. The method of claim 1, wherein performing the interval global optimization process involves performing an interval Newton step on the John conditions.

8. A computer-readable storage medium storing instructions that when executed by a computer system cause the computer system to perform a method for using a computer system to solve a global optimization problem specified by a function f and a set of equality constraints, the method comprising:

receiving a representation of the function f and the set of equality constraints $q_i(\mathbf{x}) = 0$ $(i=1,\ldots,r)$ at the computer system, wherein f is a scalar function of a vector $\mathbf{x} = (x_1, x_2, x_3, \ldots x_n)$;

storing the representation in a memory within the computer system;

performing an interval global optimization process to compute guaranteed bounds on a globally minimum value of the function $f(\mathbf{x})$ subject to the set of equality constraints;

wherein performing the interval global optimization process involves,

applying term consistency to the set of equality constraints over a subbox **X**, and

excluding portions of the subbox **X** that can be shown to violate any of the equality constraints

9. The computer-readable storage medium of claim 8, wherein performing the interval global optimization process involves:

preconditioning the set of equality constraints through multiplication by an approximate inverse matrix **B** to produce a set of preconditioned equality constraints;

applying term consistency to the set of preconditioned equality constraints over the subbox **X**; and

excluding portions of the subbox **X** that can be shown to violate any of the preconditioned equality constraints.

10. The computer-readable storage medium of claim 8, wherein performing the interval global optimization process involves:

keeping track of a least upper bound *f_bar* of the function $f(\mathbf{x})$;

unconditionally removing from consideration any subbox for which $inf(f(\mathbf{x})) > f\_bar$;

applying term consistency to the inequality $f(\mathbf{x}) \leq f\_bar$ over the subbox **X**; and

excluding portions of the subbox **X** that violate the inequality.

11. The computer-readable storage medium of claim 8, wherein applying term consistency involves:

symbolically manipulating an equation within the computer system to solve for a term, $g(x_j)$, thereby producing a modified equation $g(x_j) = h(\mathbf{x})$, wherein the term $g(x_j)$ can be analytically inverted to produce an inverse function $g^{-1}(y)$;

substituting the subbox $\mathbf{X}$ into the modified equation to produce the equation $g(X'_j) = h(\mathbf{X})$;

solving for $X'_j = g^{-1}(h(\mathbf{X}))$; and

intersecting X'_j with the interval X_j to produce a new subbox $\mathbf{X}^+$;

wherein the new subbox $\mathbf{X}^-$ contains all solutions of the equation within the subbox $\mathbf{X}$, and wherein the size of the new subbox $\mathbf{X}^+$ is less than or equal to the size of the subbox $\mathbf{X}$.

12. The computer-readable storage medium of claim 8, wherein performing the interval global optimization process involves:

applying box consistency to the set of equality constraints $q_i(\mathbf{x}) = 0$ $(i=1,\ldots,r)$ over the subbox $\mathbf{X}$; and

excluding portions of the subbox $\mathbf{X}$ that violate the set of equality constraints.

13. The computer-readable storage medium of claim 8, wherein performing the interval global optimization process involves:

evaluating a first termination condition;

wherein the first termination condition is TRUE if a function of the width of the subbox **X** is less than a pre-specified value, ε_X, and the absolute value of the function, f, over the subbox **X** is less than a pre-specified value, ε_F; and

if the first termination condition is TRUE, terminating further splitting of the subbox **X**.

14. The computer-readable storage medium of claim 8, wherein performing the interval global optimization process involves performing an interval Newton step on the John conditions.

15. An apparatus that solves a global optimization problem specified by a function f and a set of equality constraints, the apparatus comprising:

a receiving mechanism that is configured to receive a representation of the function f and the set of equality constraints $q_i(\mathbf{x}) = 0$ $(i=1,\ldots,r)$, wherein f is a scalar function of a vector $\mathbf{x} = (x_1, x_2, x_3, \ldots x_n)$;

a memory for storing the representation;

an optimizer that is configured to perform an interval global optimization process to compute guaranteed bounds on a globally minimum value of the function $f(\mathbf{x})$ subject to the set of equality constraints;

wherein the optimizer is configured to,

apply term consistency to the set of equality constraints over a subbox **X**, and to

exclude portions of the subbox **X** that can be shown to violate any of the equality constraints

16. The apparatus of claim 15, wherein the optimizer is configured to:

precondition the set of equality constraints through multiplication by an approximate inverse matrix **B** to produce a set of preconditioned equality constraints;

apply term consistency to the set of preconditioned equality constraints over the subbox **X**; and to

exclude portions of the subbox **X** that can be shown to violate any of the preconditioned equality constraints.

17. The apparatus of claim 15, wherein the optimizer is configured to:

keep track of a least upper bound f_bar of the function $f(\mathbf{x})$;

unconditionally remove from consideration any subbox for which $inf(f(\mathbf{x})) > f\_bar$;

apply term consistency to the inequality $f(\mathbf{x}) \leq f\_bar$ over the subbox **X**; and to

exclude portions of the subbox **X** that violate the inequality.

18. The apparatus of claim 15, wherein while applying term consistency, the optimizer is configured to:

symbolically manipulate an equation to solve for a term, $g(x_j)$, thereby producing a modified equation $g(x_j) = h(\mathbf{x})$, wherein the term $g(x_j)$ can be analytically inverted to produce an inverse function $g^{-1}(y)$;

substitute the subbox **X** into the modified equation to produce the equation $g(X'_j) = h(\mathbf{X})$;

solve for $X'_j = g^{-1}(h(\mathbf{X}))$; and to

intersect X'_j with the interval X_j to produce a new subbox $\mathbf{X}^+$;

wherein the new subbox $\mathbf{X}^+$ contains all solutions of the equation within the subbox **X**, and wherein the size of the new subbox $\mathbf{X}^+$ is less than or equal to the size of the subbox **X**.

19. The apparatus of claim 15, wherein the optimizer is configured to:

apply box consistency to the set of equality constraints $q_i(\mathbf{x}) = 0$ $(i=1,\ldots,r)$ over the subbox **X**; and to

exclude portions of the subbox **X** that violate the set of equality constraints.

20. The apparatus of claim 15, wherein the optimizer is configured to:

evaluate a first termination condition;

wherein the first termination condition is TRUE if a function of the width of the subbox **X** is less than a pre-specified value, ε_X, and the absolute value of the function, f, over the subbox **X** is less than a pre-specified value, ε_F; and to

terminate further splitting of the subbox **X** if the first termination condition is TRUE

21. The apparatus of claim 15, wherein the optimizer is configured to perform an interval Newton step on the John conditions.